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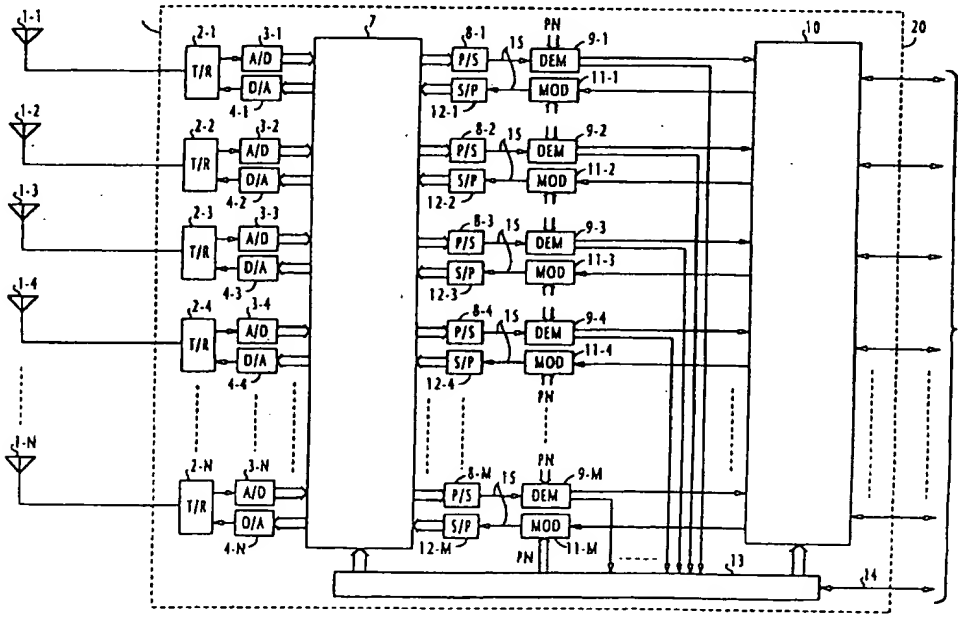
(71) Applicant: **NEC CORPORATION**
Tokyo (JP)

(72) Inventor: **Suzuki, Hideto**
Minato-ku, Tokyo (JP)

(74) Representative:
Moir, Michael Christopher et al
Mathys & Squire
100 Gray's Inn Road
London WC1X 8AL (GB)

(54) Cellsite station having switcher units to implement intra-cell handover

(57) In a cellular mobile communication system, a number of transmit/receive units are respectively connected to antenna sites for conversion of signals between a radio frequency and a baseband frequency and a number of modulator/demodulator units is provided. Control circuitry receives signals from the modulator/demodulator units indicating strengths of signals received by the antennas and controls a switcher for establishing connections between the transmit/receive units and the modulator/demodulator units. Control circuit further controls a combining circuit to combine the signals associated with at least two of the modulator/demodulator units during an intra-cell handover.



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systems are switched in the switcher 7 and diversity combined in the combining circuit 10 in the same way as those of the corresponding receive systems.

Due to the provision of the switcher 7 between the radio frequency side and the modulation/demodulation side of the base station, soft handover can be achieved without using complex circuitry and the number of leads which would otherwise be required between them can be reduced. Furthermore, by the use of A/D converters 3 and D/A converters 4 on one side of the switcher 7 and P/S converters 8 and S/P converters 9 on the other side, signals can be switched at high speeds and hence high-speed digital signal processing can be achieved by demodulators 9 and modulators 11. In addition, the use of P/S converters 8 and S/P converters 9 reduces the number of conductors leaving the modulators 11. This is advantageous for implementation of the modulator/demodulator circuitry.

Each feature disclosed in this specification (which term includes the claims) and/or shown in the drawings may be incorporated in the invention independently of other disclosed and/or illustrated features.

The text of the abstract filed herewith is repeated here as part of the specification.

In a cellular mobile communication system, a number of transmit/receive units are respectively connected to antenna sites for conversion of signals between a radio frequency and a baseband frequency and a number of modulator/demodulator units is provided. Control circuitry receives signals from the modulator/demodulator units indicating strengths of signals received by the antennas and controls a switcher for establishing connections between the transmit/receive units and the modulator/demodulator units. Control circuit further controls a combining circuit to combine the signals associated with at least two of the modulator/demodulator units during an intra-cell handover.

Claims

1. A cellular mobile communication system comprising:

   a plurality of antennas (1);
   a plurality of transmit/receive units (2) connected respectively to said antennas for conversion of signals between a radio frequency and a frequency lower than the radio frequency;
   a plurality of modulator/demodulator units (9, 11);
   control means (13) for receiving signals from said modulator/demodulator units indicating strengths of signals received by said antennas;
   switch means (7) responsive to a first control signal from said control means for establishing connections between said transmit/receive units (2) and said modulator/demodulator units (9, 11); and
   combining means (10) responsive to a second control signal from said control means for combining signals associated with at least two of said modulator/demodulator units during a handover operation.

2. A cellular mobile communication system as claimed in claim 1, wherein said modulator/demodulator units (9, 11) comprise code division multiple access modulator/demodulator units.

3. A cellular mobile communication system as claimed in claim 1 or 2, wherein said modulator/demodulator units comprise digital modulator/demodulator units, further comprising:

   a plurality of analog-to-digital converters (3) and a plurality of digital-to-analog converters (4) connected between said transmit/receive units (2) and said switch means (7), each of said analog-to-digital converters producing a multi-bit parallel output signal and each of said digital-to-analog converters receiving a multi-bit parallel input signal; and
   a plurality of parallel-to-serial converters (8) and a plurality of serial-to-parallel converters (12) connected between said switch means (7) and said modulator/demodulator units (9, 11), each of the parallel-to-serial converters converting a said multi-bit parallel output signal to a serial output signal and supplying the serial output to a corresponding one of said modulator/demodulator units and each of the serial-to-parallel converters converting an output signal from a corresponding one of the modulator/demodulator units to a said multi-bit parallel input signal.

4. A cellular mobile communication system as claimed in claim 1 or 2, wherein said frequency lower than the radio frequency signal is a baseband frequency.

5. A cellular mobile communication system as claimed in claim 1 or 2, wherein said antennas cover a plurality of equally segmented areas of a cell-site base station.

6. A cellular mobile communication system as claimed in claim 1 or 2, wherein said antennas are located alongside of a street.

7. A cellular mobile communication system as claimed in claim 1 or 2, wherein said antennas are located in dead spot zones of a cell-site base station.

8. A cellular mobile communication system as claimed in claim 3, wherein connections between said paral-

lel-to-serial converters and said serial-to-parallel converters and said modulator/demodulator units are formed by coaxial cables.

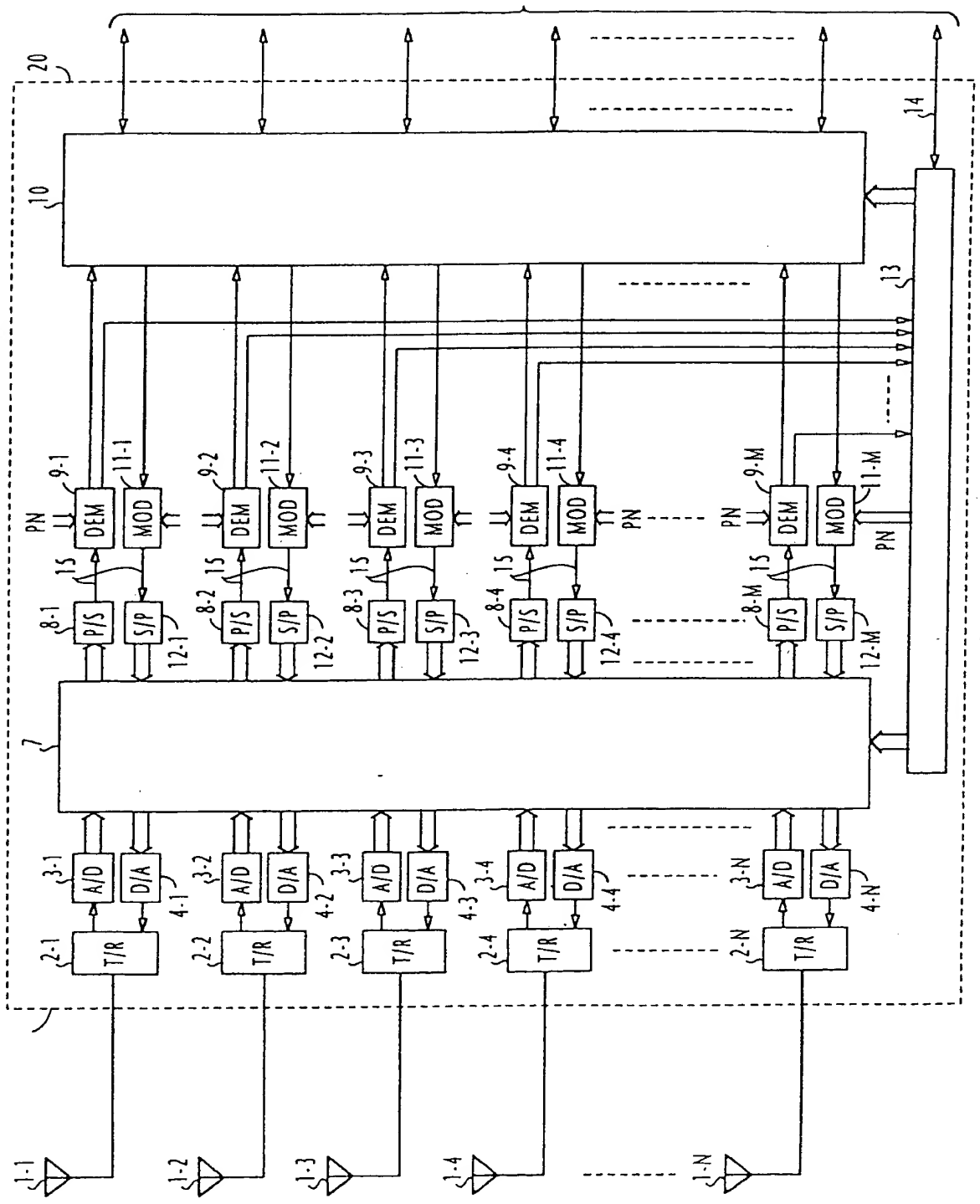
9. A cellular mobile communication system as claimed in claim 1 or 2, wherein said control means (13) is arranged to select a first group of mutually adjacent antennas and then select a second group of mutually adjacent antennas and control said switch means (7) according to the selected first and second groups.

10. A communication method for a cellular mobile communication system, wherein the system comprises a plurality of antennas (1), a plurality of transmit/receive units (2) connected respectively to said antennas for conversion of signals between a radio frequency and a frequency lower than the radio frequency, a plurality of modulator/demodulator units (9, 11); and switch means (7) disposed between said transmit/receive units and said modulator/demodulator units, the method comprising the steps of:

a) controlling said switch means (7) to establish connections between said transmit/receive units (2) and said modulator/demodulator units (9, 11);
b) making comparisons between signals from said modulator/demodulator units (9, 11) indicating strengths of signals received by said antennas to determine relative strengths of said signals;
c) determining at least two of said modulator/demodulators according to the relative strengths of said signals during a handover operation; and
d) combining signals associated with said at least two modulator/demodulator units.

11. The method of claim 10, wherein the step (a) comprises the steps of selecting a first group of mutually adjacent antennas and then selecting a second group of mutually adjacent antennas and controlling said switch means (7) according to the selected first and second groups.

12. A soft intra-cell handover method in a cellular mobile communication system comprising receiving a radio-frequency signal via a plurality of receiving antennas, demodulating each received RF signal, comparing the strengths of the demodulated signals, and establishing radio communication by selecting the RF signal providing the strongest demodulated signal for the time being, characterised in that, when another RF signal provides a stronger demodulated signal, communication is established by selecting that RF signal before communication using the RF signal previously selected is discontinued, the demodulated signals from the two RF signals being diversity combined.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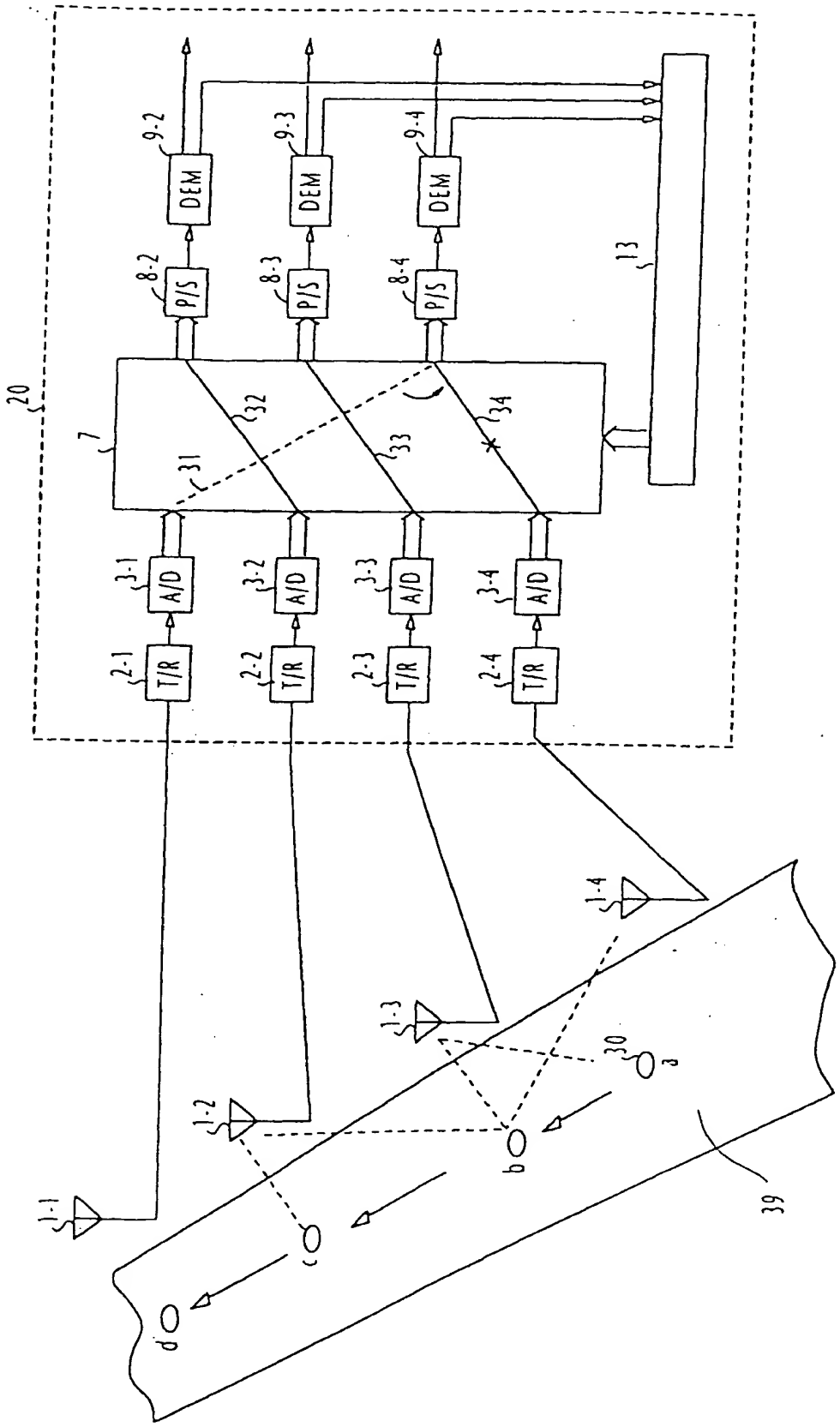
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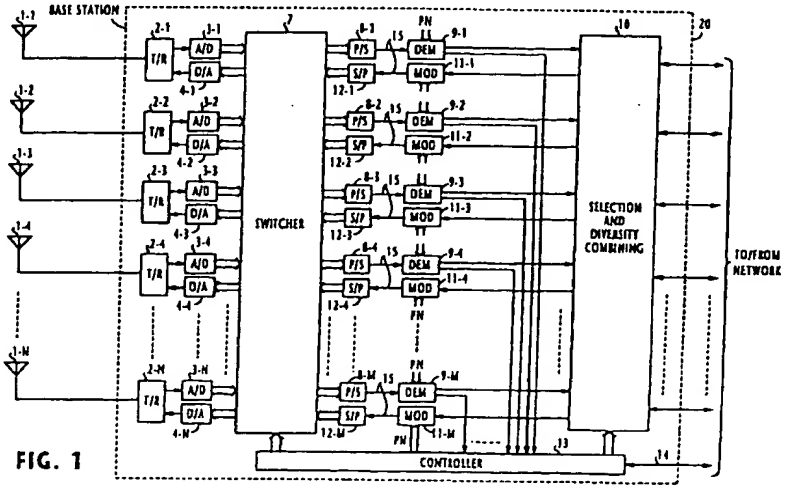

FIG. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 97 30 9551

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X A	WO 92 17954 A (PACTEL CORP) 15 October 1992 (1992-10-15) * page 28, line 11 - page 29, line 18; figure 10 *	1,2,10, 12 3-9,11	H04Q7/38 H04B7/02
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A	WO 95 05722 A (MACNAMEE ROBERT JOSEPH GERARD) 23 February 1995 (1995-02-23) * page 5, line 6 - page 8, line 12; figures *	1,10,12	
A	WO 91 07043 A (PACTEL CORP) 16 May 1991 (1991-05-16) * page 8, line 25 - page 12, line 27 *	1,10,12	
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TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H04Q
H04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30 June 2000	Gastaldi, G

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